

No. 12 — *Abyssal Mollusks from the South Atlantic Ocean*<sup>1,2</sup>

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INTRODUCTION

During the twelfth cruise of the Lamont Geological Observatory research vessel VEMA (see Ewing and Heezen, 1956) made in 1957, extensive biological and geological explorations were carried out in the Argentine Basin and off the west coast of Africa from the Agulhas Basin to the Guinea Basin. Sixteen successful bottom trawls were made in these regions, fourteen of which were from abyssal depths. In 1958, the fourteenth cruise of the VEMA again allowed opportunities to trawl in the South Atlantic, and eleven bottom samples were taken from the area between South Georgia and the Cape of Good Hope. Eight of these were also from abyssal depths. The numerous mollusks collected are nearly all quite different from North Atlantic forms, and many new species are present. Several of these are described on the following pages.

A summary of information regarding the trawling stations is given in the tables below. At station 12, a bottom trawl with an opening 3 meters wide was employed but at each of the other stations a 1 meter trawl was used. Both trawls were equipped with a fine mesh nylon net which retains all benthic animals larger than small foraminifera. At each station the trawl was in contact with the bottom for approximately 30 minutes.

R/V VEMA Abyssal Trawling Stations in the  
South Atlantic Ocean

L.G.O. Station No.	Latitude	Longitude	Corrected Depth (fathoms)
12	38°58.5' S	41°45' W	2805
14	30°14.9' S	13°03' E	1703
15	28°25.2' S	8°28.5' E	2770
16	25°33' S	12°27' E	1660
18	23°00' S	08°11' E	2262
19	22°58.5' S	07°00' E	1510
20	22°41' S	03°16' E	2767
22	5°53.5' S	09°51.5' E	1675
23	6°19.3' S	08°18.5' E	2193

<sup>1</sup> This paper is part of a doctoral thesis accepted by Harvard University in May, 1960.

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25	4°23.9' S	00°18' W	2315
46	55°19' S	37°57' W	2030
47	55°29' S	37°57' W	2054
48	56°37' S	34°38' W	1902
49	56°43' S	27°41' W	1497
50	57°39' S	13°37' W	2064
51	45°34' S	06°02' E	2507
52	41°03' S	07°49' E	2711
53	36°34' S	14°08' E	2670
54	34°35' S	17°31' E	993
57	29°44' S	37°15' E	2727
212	47°57.5' S	48°03' W	3334

Additional information is available for some of the stations, and since it may be significant it is included below.

Supplementary Information on R/V VEMA  
Stations in the South Atlantic Ocean

L. G. O. Station No.	Surface Sediment	Bottom Temp. (°C.)	Oxygen (ml/L.)	Dominant Animal Groups
12	red clay			crustaceans, mollusks
14	foraminifera	2.43	4.8	crustaceans, echinoderms, worms
15	white clay + Mn nodules			worms
16	foraminifera			echinoderms, crustaceans, nematodes
18	foraminifera	1.35		
19	foraminifera			
20	red clay	2.5	3.4	
22	greenish lutite			worms, crustaceans
23	red clay	0.76		worms, crustaceans
25	foraminifera			crustaceans

In addition to giving the localities in terms of distance and direction from selected points on the land, on the following pages ocean basins are also cited. Basin terminology follows that used by Sverdrup, Johnson, and Fleming (1942). Such a procedure is considered useful in the present study, and it is hoped that it will be adopted generally in other works dealing with the mollusks of the open sea.

## ACKNOWLEDGMENTS

Prof. Maurice Ewing generously provided the opportunity to study the mollusks on which this report is based. Much additional material for comparison was freely made available by Drs. William J. Clench and Harald A. Rehder. Dr. Clench and Dr. Ruth D. Turner also read the manuscript. The research was conducted at Harvard University and was supported by the Lamont Geological Observatory by means of Rockefeller Foundation gifts (RF. No. 57076 and No. 54087) to that institution. The National Museum of Canada provided clerical and photographic assistance during preparation of the final manuscript. All of this aid is sincerely appreciated.

## SYSTEMATIC SECTION

## Class GASTROPODA

## Order ARCHAEOGASTROPODA

## Family FISSURELLIDAE

## Genus PUNCTURELLA Lowe 1827

Type species: *Patella noachina* Linné, by monotypy.

## Subgenus FISSURISEPTA Seguenza 1863

Type species: *Puncturella (Fissurisepta) papillosa* Seguenza, subsequent designation, Woodring, 1928.

## PUNCTURELLA (FISSURISEPTA) AGULHASAE, new species

Plate 1, figure 3; Plate 2, figure 9

Shell small, about  $\frac{1}{3}$  inch in length, conical, base oval; fissure apical and elliptical; sculpture reticular; periostracum brown; and septum vertical. Base width about 88 per cent of the length, regularly ovate except slightly flattened anteriorly and finely crenulated by the radial ribs. Anterior and posterior slopes straight. Fissure apical, 1.0 mm. long, 0.9 mm. wide, and elliptical except flattened posteriorly where it intersects the apex of the septum. Fissure placed about 33 per cent of the distance from anterior to posterior. Sculpture reticulate, consisting of numerous, flat-topped, radiating costae and concentric cords. Costae about 50 near the apex and increasing to about 140 near the base. Intercostal spaces slightly narrower than

the costae and frequently bisected by radial threads which widen and become costae as they descend toward the base. Concentric cords about 90, not crossing the costae. Periostracum light brown, present chiefly in the intercostal spaces between the cords. Interior of shell whitish, glossy, and exhibiting the external sculpturing. Septum thin, vertical, originating at the posterior edge of the fissure, slightly convex, extending about  $\frac{1}{3}$  the distance to the base, and dividing the interior into two approximately equal halves.

holotype	length	width	height
	8.5 mm.	7.5 mm.	5.5 mm.

*Types.* The holotype is in the Museum of Comparative Zoology, no. 224953, from R/V VEMA station 51, Agulhas Basin about 1000 miles southwest of Capetown, South Africa, in 2507 fathoms. It was alive when collected and is the only specimen obtained.

*Remarks.* This species clearly belongs in *Fissurisepta* but it is apparently entirely distinct from all other species. In general shape it resembles *P. (P.) tenuicola* Dall 1927 (figured in Johnsonia, 2, pl. 64, figs. 4-6) from 294 fathoms off Cumberland Island, Georgia, but that species is nearly smooth externally, is striated internally, and the septum is directed posteriorly. The other known species in the subgenus are more dissimilar.

*Fissurisepta* is primarily an archibenthal group with wide but scattered distribution in the subtropical portion of the North Atlantic, and the present species represents a sizable extension of the geographic and bathymetric range of the subgenus. For an excellent review of the genus *Puncturella* in the Western Atlantic see Johnsonia, 2: 116-148 (1947).

*Records.* Known only from the type locality.

## Family SEGUENZIIDAE

### Genus SEGUENZIA "Jeffreys" Seguenza 1876

Type species: *Seguenzia formosa* Jeffreys, subsequent designation, Harris, 1897.

Verrill (1884) erected a separate family (Seguenziidae) for *Seguenzia* and *Basilissa* (Watson, 1879) and because of its radular characteristics placed it next to the Strombidae (Mesogastropoda). Other authors (Dall, 1889a, 1927b; Woodring, 1928; Johnson, 1934) retained the group as a family but did not agree on its relationships. Thiele (1925, 1931) placed *Seguenzia* in



the Trochidae (Archaeogastropoda) under the subfamily Margaritinae. This action was followed uncritically by Wenz (1938).

The characteristic morphology of *Seguenzia* sets these archibenthal and abyssal gastropods apart from all others. They resemble members of the archaeogastropod family Trochidae in shell shape and in the possession of nacre, but the radula approaches the typical taenioglossate type of mesogastropods, and the aperture is characterized by having one well developed posterior sinus and one or two anterior ones. The present writer therefore follows earlier authors in regarding *Seguenzia* as belonging to a separate family, the Seguenziidae. Its place in the system is questionable, but for the present, it is left next to the Trochidae following Johnson, 1934. *Basilissa* probably belongs here also.

According to Wenz (1938: 277) the oldest fossils of *Seguenzia* are from the Eocene. There are also morphological similarities between *Seguenzia* and the Ordovician to Devonian genus *Pro-turritella* Koken 1889 figured by Wenz (1938, fig. 436 b, c, e) and Knight (1941, pl. 39, fig. 5 a-c). Knight (personal communication) concludes that the resemblance is probably superficial.

In addition to the uncertainties regarding the systematic status and position of *Seguenzia*, difficulties often arise in defining the morphological limits of the included species. The following quotation from Dall (1889a: 269) illustrates this condition in *S. formosa* Jeffreys (= *S. monocingulata* [Seg.]).

"In examining the specimens of *Seguenzia* . . . I find myself in a dilemma. Either each separate individual is to be regarded as a species, or the variability of the shells is very great. Persistent study of the specimens has convinced me that the latter is the true solution, and that the most evident characters, such as the umbilicus (in some adult specimens) may be present or absent; that the number of spiral threads, their strength and sharpness on the basal disk, are entirely inconstant, and, while in the typical *formosa* the ridge next to the suture is waved or granulate, in many it is perfectly plain."

Similar variation is seen in other species of *Seguenzia* and minor differences probably cannot be used to separate species. It is with such a liberal attitude that the following specimens have been identified, several of which are slightly different from the type specimens or original figures with which they were compared, but sufficiently close to be considered conspecific.

## SEGUENZIA ANTARCTICA Thiele 1925

## Plate 3, figure 10

Three specimens were found which seem to fit this species, one each at station 18 (2262 fathoms, near the northern edge of the Cape Basin and approximately 400 miles west of Walvis Bay, South-West Africa), station 50 (2064 fathoms, near the southern end of the Mid-Atlantic Ridge in the Atlantic Indian Antarctic Basin), and station 53 (2670 fathoms, Cape Basin, about 300 miles southwest of Capetown, South Africa). The species is truly abyssal; the only other recorded specimen being Thiele's type collected from approximately 2520 fathoms at 63°16.5' S, 57°51' E in the eastern end of the Atlantic Indian Antarctic Basin.

## SEGUENZIA ERITIMA Verrill 1884

## Plate 3, figure 6

One specimen collected at station 12 (2805 fathoms, mid-Argentine Basin, about 100 miles east-southeast of Buenos Aires) and two at station 18 (2262 fathoms, north edge of Cape Basin) seem to be nearer to *eritima* than to any other described species. *S. eritima* was recorded by Verrill from 1290 to 2033 fathoms south of Marthas Vineyard, Massachusetts. It is possible that the specimens here reported represent another, closely related species but they are too immature and worn to describe.

## SEGUENZIA ELEGANS Jeffreys 1876

## Plate 2, figure 7; Plate 3, figure 5

Two specimens, one from station 12 (2805 fathoms, Argentine Basin) and one from station 18 (2262 fathoms, Cape Basin) agree rather closely with specimens of *elegans* in the Jeffreys Collection now in the United States National Museum (no. 181660). *S. elegans* was described from between 740 and 1095 fathoms off Portugal. The specimens also somewhat resemble *S. orientalis* Thiele 1925 from off East Africa in 379 fathoms, but are apparently closer to *elegans* than to any other species.

## SEGUENZIA CARINATA Jeffreys 1876

## Plate 4, figure 6

Four specimens of this species were found, three at station 14 (1703 fathoms, Cape Basin, about 400 miles northwest of Capetown, South Africa) and one at station 50 (2064 fathoms,

near the south end of the Mid-Atlantic Ridge, Atlantic Indian Antarctic Basin). The identifications here are more certain than in the case of any of the other *seguenzias* found. *S. carinata* has been recorded from depths ranging from 675 to 2199 fathoms at various localities in the North and South Atlantic, but apparently not previously from the basins herein reported.

SEGUENZIA LOUISEAE, new species

Plate 4, figure 4

Shell small (2.4 mm. high), trochiform, strongly carinate, narrowly umbilicate, and fragile. Color white to slightly yellowish. Whorls five, with a sharp, prominent, finely undulate, peripheral carina and a second, large, slightly less angular carina between the periphery and the suture. On the upper whorls the latter carina appears to carry two parallel threads on its blade. Peripheral carina visible only on the body whorl. Basal disc with about twelve narrow additional carinae, the most prominent being the outer carina and that surrounding the umbilicus. Finer sculpturing on the spire consisting of one fine revolving thread below the suture and two to four fine revolving threads below the central carina. Fine, evenly spaced, longitudinal, sigmoid threads are also present on the top of the whorls and on the basal disc, gradually becoming finer on the latter as they approach the umbilicus. These threads parallel the lines of growth and indicate the presence of a well developed anterior and posterior sinus when the aperture is undamaged. Aperture iridescent within, subrhomboid, irregular, and expanded where it intersects the carinae. Columella slightly curved and extending in a tooth-like projection. Umbilicus deep and narrow, about one-twelfth the width of the shell. Nuclear whorl smooth, of medium size, paucispiral and slightly bulbous. Operculum thin, light yellow, and ear shaped.

	height (mm.)	width (mm.)
holotype, station 51 (dead)	2.4	2.7
paratype, " " (dead)	2.3	2.2 <sup>1</sup>
" " " (dead)	1.7	1.7
" " " (alive)	1.6	1.6
" " " (alive)	0.8	0.9

*Types.* The holotype and four paratypes are from R/V VEMA biology station 51 (2507 fathoms, Agulhas Basin, about

<sup>1</sup> Last whorl broken away.

1450 miles southwest of Capetown, South Africa). Two additional paratypes are from station 18 (2262 fathoms, northern end of Cape Basin, about 400 miles west of Walvis Bay, South West Africa). The holotype is no. 224951 and the paratypes from station 51 are no. 224952 in the Museum of Comparative Zoology. Paratypes from station 18 are no. 4739 in the National Museum of Canada.

*Remarks.* In general shape, thickness, and in possession of an acute, nearly blade-like peripheral carina, *S. louiseae* more closely resembles *S. carinata* Jeffreys than any other species. The carina between the periphery and the suture is much heavier than in Jeffreys' figures of *carinata* (P.Z.S. 1885, pl. 5, figs. 3, 3a) however, and the sinuous axial threads, so prominent in *louiseae*, are absent on *carinata*. Although *louiseae* is apparently a very distinct species, it seems to be intermediate in general structure between *carinata* and the more heavily sculptured species of *Seguenzia*, e.g. *ionica* Watson and *costulifera* Schepman.

I take pleasure in naming this species for my wife, Louise R. Clarke.

*Records.* Known only from stations 51 and 18, cited above under 'Types'.

## Family CYCLOSTREMATIDAE

### ABYSSOGYRA, new genus

Type species: *Abyssogyra vemae*, Clarke.

Shell small, planorbiform, weakly sculptured, and with a multispiral, corneous operculum. Sculpturing limited to lines of growth and two faintly developed, revolving carinae. Additional characters are those of the type species.

*Abyssogyra* lacks the heavy sculpturing and the beaded operculum of *Cyclostrema*, Marryat. It differs from *Circulus* Jeffreys in not being longitudinally ribbed. *Pseudomalaxis* Fischer, *Omalaxis* Deshayes, *Zalipais* Suter, *Omalogyra* Jeffreys, and the several genera erected by Bush (1897) and by Pilsbry and McGinty (1945-46) all differ in prominent characters from *Abyssogyra*.

Abbott (1950) has fixed the identity of the problematical *Cyclostrema cancellata* of Marryat, the type species of *Cyclostrema*, and this has had the effect of restricting the genus to include only the small, planorboid, heavily sculptured species with beaded opercula occurring in shallow water in the tropics.

This has left many of the deep sea species formerly placed in *Cyclostrema* without a proper genus. After a careful search of the literature, it has become clear that such is the case with *Cyclostrema normani* Dautzenberg and Fischer 1897. Since the species described below is apparently congeneric with *normani*, a new genus (i.e. *Abyssogyra*) is necessary to receive it.

ABYSSOGYRA VEMAE, new species

Plate 3, figure 4

Shell minute (1.8 mm. wide), planorbiform, weakly sculptured, and white in color. Periostracum brown, thin, and present only in small patches. Whorls two, nearly circular in cross-section. Suture deep. Spire depressed, projecting only slightly above the body whorl. Aperture circular except in the parietal region where it is nearly straight and slightly thickened. Outer and inner lips thin and sharp. Umbilicus wide and extending to the nuclear whorl. Sculpture consisting of lines of growth and two low, medially located, revolving carinae, one located on the dorsal side of the whorls and one located ventrally. Two additional revolving carinae intersect the ends of the straight parietal lip: the upper one borders the suture, the lower ascends into the umbilicus. Nuclear portion bulbous, unsculptured, and consisting of one-half whorl. Operculum thin, corneous, yellowish gray, multispiral, and spirally ridged.

	major diameter	minor diameter	height
holotype	1.8 mm.	1.3 mm.	0.9 mm.

*Types.* The holotype was collected at station 49 (1497 fathoms, 56°43' S, 27°41' W, Atlantic Indian Antarctic Basin, south of Traverse Island, South Sandwich Islands). Only one specimen, a living one, was obtained. The holotype is in the Museum of Comparative Zoology, no. 224962.

*Remarks.* As stated above, in shell characters this species resembles a *Cyclostrema* without prominent sculpturing. It is probably closest to *Abyssogyra normani* (Dautzenberg and Fischer) but that species differs in having the aperture width approximately one-third the width of the shell and the spiral carinae very faintly developed, while in *vemae*, the aperture is approximately one-half the width of the shell and the carinae are rather well developed. It is also somewhat similar to *Homalogyra denticostata* Jeffreys 1884, except that in that species the spire is depressed below the level of the body whorl.

and the concentric sculpturing is slightly sigmoid and more prominent.

*Records.* Known only from the type locality.

### Genus BROOKULA Iredale 1912

Type species: *Brookula stibarochila* Iredale 1912, original designation.

Through the kindness of Dr. Donald F. McMichael of the Australian Museum, Sydney, and Dr. Harald A. Rehder of the United States National Museum, I have been able to examine the holotypes of *Brookula stibarochila* Iredale 1912 (Pl. 1, fig. 5) and *Vetulonia galapagana* Dall 1913 (Pl. 1, fig. 1), the type species of the genera *Brookula* and *Vetulonia*, respectively.

The anatomy and radular characteristics of these two species are unknown, but examination of the shells has led to the conclusion that their relationships are sufficiently distant to make it desirable to place them in different subgenera. *B. stibarochila*, a shallow water tropical species, is minute, umbilicate, covered with axial ribs which are approximately vertical, has a beaded aperture which is nearly parallel with the columella, and has a white, glass-like shell. *Vetulonia galapagana*, an abyssal species, is much larger, non-umbilicate (the umbilicus is neatly filled with a callus), covered with oblique axial ribs, has a plain, oblique (prosocline) aperture and a white, somewhat chalky shell.

In addition, many of the archibenthal and abyssal species formerly placed in *Brookula* appear to belong to a third group distinct from *Brookula* (*sensu stricto*) and from *Vetulonia*. This group is described below as a new subgenus and is given the name *Benthobrookula*.

### BENTHOBROOKULA, new subgenus

Type species: *Brookula* (*Benthobrookula*) *exquisita* Clarke, original designation.

Shells small, umbilicate, sculptured with axial ribs which are approximately vertical and with spiral threads or costae, with a plain, nearly vertical aperture, a relatively large and slightly bulbous protoconch, and with a white, opaque, solid shell.

*Benthobrookula* differs from *Brookula* (*sensu stricto*) in the following characters. *Benthobrookula* has a somewhat bulbous



and relatively large protoconch; the aperture is plain, i.e. not beaded or otherwise sculptured although it may be thickened; the costae are narrow and symmetrical in cross-section; and the shell is not glassy and not translucent. *Brookula* (*sensu stricto*) has a small protoconch; the aperture is beaded; the costae are flattened, rounded in front and blade-like behind; and the shell is glassy and translucent and appears like a tropical species which, of course, it is. In operculum characteristics, the two subgenera are very similar.

From *Vetulonia*, *Benthobrookula* differs as follows. *Vetulonia* has the umbilicus neatly filled with a callus, the ribs are oblique, and the aperture is strongly prosocline. *Benthobrookula* is openly umbilicate and the ribs and the aperture are approximately vertical. Anatomical studies are necessary in all three of these groups, and the results of such studies may support or confound the division here proposed.

Thiele (1925: 57, 71) pointed out that much confusion existed in the proper placement of the small shells previously assigned to *Cyclostrema* (e.g. *Brookula*, *Vitrinella*, etc.) and proposed three groups to include them: (1) Skeneidae in which the radula has 4 or 5 lateral teeth, (2) Cyclostrematidae which has only one lateral tooth and a few weak marginal teeth, and (3) Vitrinellidae which is taenioglossate. The radula of *Brookula powelli*, n. sp. (Pl. 4, fig. 9) most clearly fits the Cyclostrematidae, notwithstanding possible differences in interpretation concerning which are lateral and which are marginal teeth.

BROOKULA (BENTHOBROOKULA) POWELLI, new species

Plate 3, figure 7; Plate 4, figures 1 and 9

Shell minute (2.3 mm. wide), trochiform, depressed, umbilicate, prominently sculptured, and grayish white. Whorls  $2\frac{5}{6}$ , convex, separated by a depressed suture and forming a slightly obtuse spire. Sculpture consisting of numerous, rather heavy, narrow, longitudinal ribs (40 on the body whorl and 32 on the penultimate whorl of the holotype) and numerous, very fine revolving threads (about 30 on the body whorl of the holotype) which do not cross the ribs. The threads become somewhat stronger on the base of the shell, but except for the four cords which surround the umbilicus, the spiral striations never approach the ribs in strength. The four cords around the umbilicus are of approximately the same strength as the ribs. Aperture complete, ovate, somewhat angled posteriorly



and flattened where it is appressed to the preceding whorl. Outer and inner lips slightly thickened. Umbilicus rather wide and extending far up into the shell. Periostracum apparently absent. Protoconch bulbous, smooth, and composed of one-half whorl. Operculum thin, round, corneous, multispiral, and yellowish. Radula (from a station 51 specimen) shown in Plate 4, figure 9.

	height (mm.)	width (mm.)	whorls
holotype, station 12	1.9	2.3	2 $\frac{5}{8}$
paratype, station 51	1.6	2.0	2 $\frac{7}{8}$
paratype, station 51	1.5	1.7	2 $\frac{5}{8}$
paratype, station 51	1.3	1.4	2 $\frac{3}{4}$

*Types.* The holotype containing the animal is from R/V VEMA biology station 12 (2805 fathoms, mid-Argentine Basin, about 1000 miles east-southeast of Buenos Aires, Argentina). One paratype, living when collected, is from station 48 (1902 fathoms, about 100 miles southeast of South Georgia) and thirteen paratypes, most of which contain the animal, are from station 51 (2507 fathoms, about 1000 miles southwest of the Cape of Good Hope). The holotype is no. 224960 in the Museum of Comparative Zoology. Paratypes are in the Museum of Comparative Zoology and the National Museum of Canada.

*Remarks.* *Brookula* (*Benthobrookula*) *powelli* is similar to *Brookula strebeli* and *B. pfefferi* (both Powell, 1951, from off South Georgia in 85 to 97 fathoms) in general appearance and in the possession of umbilical cords, but those species are higher than wide and exhibit 3 $\frac{1}{2}$  and 4 $\frac{3}{4}$  whorls, respectively, although they are both smaller than the holotype of *powelli* which has only 2 $\frac{5}{8}$  whorls. In addition, the axial sculpturing and the spiral threads are finer on *powelli*.

The species is named for Dr. A. W. B. Powell of the Auckland Museum, who has been for many years the leading authority on Antarctic mollusks.

*Records.* Known only from the localities cited above under 'Types'.

#### BROOKULA (BENTHOBROOKULA) EXQUISITA, new species

Plate 3, figure 8; Plate 4, figure 2

Shell minute (1.8 mm. wide), trochiform, depressed, umbilicate, heavily sculptured, and white. Whorls 2 $\frac{3}{4}$ , convex, separated by a depressed suture and forming a spire which is

produced at an angle of about  $120^\circ$ . Sculpture consisting of numerous rather heavy, narrow, longitudinal ribs (28 on the body whorl and 23 on the penultimate whorl of the holotype) and many prominent revolving cords (17 on the body whorl of the holotype), which give the shell a cancellated appearance. The cords on the top of the whorls are weaker than the ribs, but on the base, except for the three major cords surrounding the umbilicus, the cords and ribs are of approximately the same strength. The three cords near the umbilicus are more widely spaced and are much heavier than the ribs. Aperture circular except slightly flattened where it is appressed to the preceding whorl and lightly crenulated by the three major basal cords. Outer lip somewhat thickened, inner lip a little thinner. Umbilicus deep, wide at the base and narrowing as it ascends. Periostracum apparently absent. Nuclear portion bulbous, smooth, and composed of one-half whorl. Operculum thin, round, corneous, multispiral, and yellowish.

	height (mm.)	width (mm.)	whorls
holotype, station 47	1.5	1.8	$2\frac{3}{4}$
paratype, station 47	1.2	1.4	$2\frac{2}{3}$

*Types.* The holotype and one paratype, both living specimens, were dredged at R/V VEMA Biology Station 47 (2054 fathoms, approximately 60 miles south of South Georgia). The holotype is no. 225954 in the Museum of Comparative Zoology and the paratype is no. 4742 in the National Museum of Canada.

*Remarks.* This species more closely resembles *B. powelli* than any other species, but the spiral cords are very much heavier in *exquisita* and the spire is markedly more obtuse. *B. pfefferi* Powell (1951) and *B. strebeli* Powell (*loc. cit.*) are somewhat similar also, but in those species the spire is acute and the spiral threads are very weak, nothing like the robust thickness of the threads in this species.

*Records.* Known only from the type locality.

#### BROOKULA (BENTHOBROOKULA) LAMONTI, new species

##### Plate 4, figure 3

Shell minute (1.5 mm. wide), trochiform, not depressed, sculptured, umbilicate, and white. Whorls  $3\frac{1}{4}$ , convex, separated by a sharply defined, depressed suture and forming a slightly acute spire. Sculpture consisting of numerous, sharp, somewhat elevated longitudinal ribs (25 on the body whorl and 22 on

the penultimate whorl of the holotype) and many fine, low, revolving threads (about 20 in the holotype) which do not cross the ribs. The threads become a little stronger on the base of the shell, but except for the two threads which border the umbilicus, they are much weaker than the ribs. The two cords near the umbilicus are about the same strength as the ribs. Aperture ovate-ear shaped, angled posteriorly and flattened where it is appressed to the preceding whorl. Outer and inner lips thickened. Umbilicus rather narrow and deep. Periostracum apparently absent. Nuclear portion partly broken in the holotype but apparently bulbous, smooth, and composed on one-half whorl. Operculum thin, round, corneous, multispiral, and yellowish.

	height (mm.)	width (mm.)	whorls
holotype, station 47	1.5	1.4	3¼

*Types.* The holotype, an unique specimen, was collected alive at R/V VEMA biology station 47 (2054 fathoms, Scotia Sea about 60 miles south of South Georgia). It is at the Museum of Comparative Zoology, no. 225953.

*Remarks.* This species is grossly similar to *B. pfefferi* Powell (1951) and *B. strebeli* Powell (*loc. cit.*) (which are so similar to each other that they appear to represent the same species), but *lamonti* has a much thicker lip than either of those species, the aperture is angular posteriorly while in *pfefferi* and *strebeli* it is not, and the umbilical area in *lamonti* is more open and quite differently sculptured. From *powellii* and *exquisita*, described above, *lamonti* may be differentiated by its slightly acute spire, its heavier lip, its less prominent ribs, and its more chalky appearance.

This species is named for the Lamont Geological Observatory, the sponsor of the expeditions which led to the discovery of the mollusks here described.

*Records.* Only one specimen is known. See under 'Types'.

#### BROOKULA (BENTHOBROOKULA) CAPENSIS, new species

##### Plate 1, figure 4

Shell small (3.4 mm. wide), trochiform, not depressed, heavily sculptured, white on the ribs and light brown between them. Spire turreted and acute. Whorls approximately 3 to 4 (nuclear portion broken away), convex, and separated by a deep suture. Sculpture consisting of numerous, elevated, slightly sigmoid

longitudinal ribs (26 on the body whorl and 20 on the penultimate whorl of the holotype) with one to three low longitudinal threads in the spaces between the ribs. Numerous fine spiral threads are also present (about 35 on the body whorl in the holotype) extending all over the whorls and up into the umbilicus. The threads on the base are a little heavier, but no prominent cords surround the umbilicus. Aperture ovate, slightly angular posteriorly, and in contact with the preceding whorl only in a narrow zone. Lip thickened anteriorly and only slightly thickened elsewhere. Umbilicus narrow and deep. Periostracum thin, light brown. Nuclear whorls not visible. Operculum thin, round, corneous, multispiral, light brown generally with a yellowish-green central area.

	height (mm.)	width (mm.)	visible whorls
holotype	3.2 <sup>1</sup>	3.0	2½

*Types.* The holotype, an unique specimen, was collected alive at R/V VEMA biology station 53 (2670 fathoms, Cape Basin, about 300 miles southwest of Capetown, South Africa). It is in the Museum of Comparative Zoology, no. 225952.

*Remarks.* With respect to lacking umbilical carinae, this species is similar to *B. valdiviae* Thiele 1925, *B. kerguelensis* Thiele 1925, *B. decussata* (Pelseneer) 1903, *B. conica* (Watson) 1886, *B. crassicostata* (Strebel) 1908, *B. calypso* (Melville and Standen) 1912, and *B. cancellata* (Jeffreys) 1883. However, in addition to being larger than any of these, the following differences may be seen.

The spire of *capensis* is acute while that of *crassicostata* and *cancellata* is obtuse. In *capensis* the ribs are sigmoid and the spiral striae cross the ribs, while in *valdiviae*, *kerguelensis*, *conica*, and *decussata* the ribs are straight and the spiral striae do not cross them. *B. calypso* differs in having straight ribs and two prominent lines around the penultimate whorl.

*Records.* Known only from the type specimen. See 'Types'.

## Family CHORISTIDAE

### Genus CHORISTES Carpenter 1872

Type species: *C. elegans* Carpenter 1872, by monotypy.

The genus *Choristes* was proposed by Carpenter (in Dawson, 1872) to receive the post-Pliocene species *C. elegans* Carpenter.

<sup>1</sup> Upper whorl(s) broken away.

Verrill (1882) described a living species from 255 fathoms off Marthas Vineyard which he considered only as a variety of *elegans*, viz. *C. elegans* var. *tenera*. Bush (1897), working with additional material from off Marthas Vineyard, compared the radula of a similar species from 390 fathoms with *tenera*. She found that the "new" species possessed two single overlapping lateral teeth (Bush, 1897, pl. 23, fig. 16) in the position occupied, in *tenera*, by the single, wide, bilobed second lateral (Verrill 1882, pl. 58, fig. 27a) and that there were consequently thirteen teeth in each transverse row in the new species instead of eleven, the number in *tenera*. Bush therefore created the new genus *Choristella* to receive this new species (*leptalea*) and another species (*brychia*) represented by a single dead specimen dredged off Marthas Vineyard in 810 fathoms and described in the same paper.

Examination of the type specimens of the above species from the collections of the United States National Museum has resulted in the following conclusions. In shell characters *tenera* and *elegans* are very similar except that the shell of *tenera* is much thinner than that of *elegans*, as was pointed out by Verrill (*loc. cit.*) In view of this constant and striking difference and the fact that *elegans* is post-Pliocene and existed in shallow water while *tenera* is recent and archibenthal, the two forms are here considered as separate species.

On the other hand, the type specimens of *leptalea* and *brychia*, although not equally corroded, are apparently identical to each other and to *tenera*. The type localities of the three species are all in the same general area on the continental slope south of New England. In view of these factors, the writer considers that the differences in the radulae which have been illustrated (*loc. cit.*) may be due to different interpretations by the two authors as to whether the second lateral was actually a single, wide tooth with two cusps, or two separate, overlapping teeth each with a single cusp, and that both authors probably observed radulae of the same species.

It is, therefore, considered that the family Choristidae contains only the genus *Choristes*, with *Choristella* as a synonym. After the addition of two species described by Dall (not discussed above) the list of species in *Choristes* is as follows: *elegans* Carpenter 1872, *tenera* Verrill 1882, *carpenteri* Dall 1896, *pompholyx* (Dall) 1889, *agulhasae* (*sensu stricto*) and *agulhasae argentinae*, a new species and a new subspecies to be described below.

## CHORISTES AGULHASAE, new species

## Plate 3, figure 1

Shell small (3.0 mm. wide), somewhat depressed, moderately sculptured, umbilicate, semi-transparent, and very fragile. Whorls three, convex, separated by an incised suture, and forming a flattened, obtuse spire. Color grayish white except on the body whorl where the shell becomes transparent and longitudinal streaks of white appear. Sculpture consisting of fine lines parallel to the lines of growth; a low, centrally located, basal carina; a second carina running up inside the umbilicus; and a low carina on the upper part of the whorl near the suture. The latter carina becomes obsolete on the body whorl. Aperture large, ovate, and flattened at the inner edge. Inner lip nearly straight, oblique, and thin. Outer lip thin and convex. Umbilicus rather wide and extending to the protoconch. Protoconch small, planospiral, and consisting of about  $\frac{1}{2}$  whorl. Operculum diaphanous, transparent, and apparently paucispiral.

	height (mm.)	width (mm.)	whorls
holotype	2.0	3.0	3

*Types.* The holotype, an unique specimen, was collected alive and unbroken at R/V VEMA biology station 51 (2507 fathoms, Agulhas Basin, approximately 1000 miles southwest of Cape-town, South Africa). It is in the Museum of Comparative Zoology, no. 224955.

*Remarks.* This species, the first in this genus to be recorded from the Southern Hemisphere, is readily distinguished from all other species of *Choristes* by its rather strong basal carinae and long, straight parietal lip. (For differential characters between this and the following subspecies *C. a. argentinæ*, see *Remarks* under *argentinæ*.) The other species all lack the carinae and exhibit a curved parietal lip. In addition, *pompholyx* Dall is thicker, white, and polished, while *elegans* Carpenter and *tenera* Verrill appear to be much larger species, although, of course, we do not know what the maximum size of *agulhasæ* may be.

*Records.* The holotype is the only known specimen. See under 'Types'.

## CHORISTES AGULHASAE ARGENTINÆ, new subspecies

## Plate 3, figures 2 and 3

Shell small (3.5 mm. wide), somewhat depressed, loosely coiled, moderately sculptured, umbilicate, heavily eroded, and rather fragile. Apex decollated, leaving only  $1\frac{2}{3}$  whorls. Color



light yellowish brown except white where the outer layer of the shell has been corroded away. Whorls convex, enlarging rapidly, separated by a narrow incised suture, and touching only in a narrow peripheral zone. Sculpture visible only in uncorroded areas and consisting of fine, incremental lines parallel to the lines of growth. There is a single, prominent, centrally located carina on the base of the body whorl and another carina, scarcely visible in the holotype because of corrosion, but apparently revolving up inside the umbilicus. Aperture large and obliquely D-shaped. Inner lip straight, oblique and slightly thickened. Outer lip rather thin and convex. Umbilicus rather wide, extending through the shell, and exposed apically. Protoconch and operculum not present.

	height (mm.)	width (mm.)	whorls
holotype	2.3	3.5	1 $\frac{2}{3}$

*Types.* The holotype, without the animal and an unique specimen, was collected from R/V VEMA biology station 12 (2805 fathoms, mid-Argentine Basin, approximately 1000 miles east-southeast of Buenos Aires, Argentina). It is in the Museum of Comparative Zoology, no. 224956.

*Remarks.* This subspecies is similar to *C. agulhasae* (*sensu stricto*) except for the following characters. *C. a. argentinae*, where it is not corroded, exhibits a somewhat thickened, semi-translucent shell with a yellowish periostracum while in *C. agulhasae* the shell is uniformly thin (much thinner than *argentinae*), transparent on the body whorl, and without any visible periostracum. In addition, the uncorroded portions of *argentinae* indicate that the region of the body whorl adjacent to the suture is slightly concave, a characteristic not seen in *agulhasae*. Finally, the aperture in *argentinae* is more expanded and the parietal lip is straighter, longer, and much thicker than in *agulhasae*.

*Records.* Known only from the type locality. See under 'Types'.

## Order MESOGASTROPODA

### Family NATICIDAE

#### Genus AMAUOPSIS Mörch 1857

Type species: *Natica helicoides* Johnston 1835, subsequent designation, Dall 1909.



Subgenus **KERGUELENATICA** Powell 1951

Type species: *A. (K.) grisea* (von Martens) 1878, original designation, Powell 1951.

**AMAUOPSIS (KERGUELENATICA) GRISEA** (von Martens) 1878

## Plate 1, figure 6

One dead specimen which appears to be this species was trawled at R/V VEMA station 14 (1703 fathoms, Cape Basin, about 400 miles northwest of Capetown, South Africa). It was inhabited by a pale, blind, abyssal hermit crab. Another specimen, living when collected, which unquestionably belongs to *grisea*, was trawled at station 51 (2507 fathoms, Agulhas Basin, about 1000 miles southwest of Capetown, South Africa). This exhibited the characteristic operculum which is horny with a prominent, thin calcareous layer over the central part, and was otherwise identical to the published figures of *grisea*. A third specimen, which is probably this species, was trawled, also alive, at station 47 (2054 fathoms, Scotia Sea, about 60 miles south of South Georgia). It too is very similar to the published figures of *grisea* but the operculum has a heavier calcareous layer than in typical *grisea* and it covers the entire outer surface.

About six other naticoid species are present in the R/V VEMA material from stations 46, 47, 49, and 51 (1497 to 2507 fathoms, Scotia Sea and Agulhas Basin), but without type material for comparison I do not wish to name them at this time. They appear to belong to the group characterized by Hedley (1916) as follows: "There is an Antarctic naticoid group which . . . amounts to about a dozen rather featureless species, all small, mostly uniform olive buff in color, four whorls, a slightly raised spire, a caducons epidermis, comparatively thin, unsculptured, except for incremental striae, without umbilical funicle or a callus pad at the insertion of the right lip. Operculum corneous paucispiral." Since the VEMA stations are in general much deeper than any other stations in the sub-Antarctic from which mollusks have been reported, identifications of these species with previously described species would appear to constitute large extensions of their bathymetric ranges, and such extensions might be incorrect.

## Order NEOGASTROPODA

Family BUCCINULIDAE<sup>1</sup>

## Genus TROMINA Dall 1918

Type species: *Fusus unicarinatus* Philippi, original designation.

## TROMINA BELLA ABYSSICOLA, new subspecies

Plate 2, figure 10; Plate 4, figure 7

Shell small (11.8 mm. long) buccinoid, moderately sculptured, and thin. Whorls  $3\frac{2}{3}$ , convex, separated by a rather deep suture, and forming a spire which subtends an angle of about  $70^\circ$ . Sculpturing consists of numerous, narrow, low, closely spaced spiral ribs (about 45 on the body whorl of the holotype) and numerous unevenly spaced axial ribs (about 75 on the body whorl of the holotype) similar to the spiral ribs in height and thickness, which give the surface a reticulated appearance. Aperture rather large and with a wide siphonal canal, smooth and shiny within and there exhibiting the external sculpture. Columella twisted. Parietal wall convex anteriorly and posteriorly, concave medially with a straight central portion, and with a thin callus over its whole surface. Outer lip thin, sharp, broadly convex, and crenulated by the spiral ribs. Umbilicus absent. Periostracum rather thin but prominent and yellowish brown. Nuclear whorls  $1\frac{3}{4}$ , forming a dome-shaped protoconch sculptured with fine, slightly wavy, longitudinal ribs and nearly imperceptible spiral lines. Operculum thin, filling about half the aperture, light yellowish, paucispiral, and with the nucleus sub-terminal. Radula with a tricuspid central tooth and bicuspid marginals (Pl. 4, fig. 7).

	height (mm.)	width (mm.)	whorls
holotype, station 51	11.8	7.5	$3\frac{2}{3}$
paratype, station 51	7.2	4.9	$3\frac{1}{2}$

*Types.* The holotype and one paratype, the only specimens known, were collected alive at R/V VEMA biology station 51 (2507 fathoms, Agulhas Basin, about 1000 miles southwest of Capetown, South Africa). The holotype is in the Museum of Comparative Zoology, no. 224954. The paratype is in the National Museum of Canada, no. 4739.

<sup>1</sup> The writer is following Powell (1951) in the use of this family name.

*Remarks.* *T. bella abyssicola* is similar to *T. bella* Powell 1951 (82-152 fathoms, from four localities near the Falkland Islands) in most of its characters and is apparently closely related to it. The observed differences seem to be entirely sufficient to justify its subspecific status however, especially in view of the great divergence in depth and the great distance between the localities.

*T. b. abyssicola* is a much thinner and more delicate species than *T. bella*. The external sculpturing shows clearly inside the aperture in *abyssicola* but does not show in *bella*. The parietal wall in *abyssicola* has a straight portion in the center while in *bella* the central region is rather evenly concave. In addition, the central tooth of the radula of *abyssicola* bears a larger central and two markedly smaller lateral cusps and the two cusps of each marginal are of approximately equal size (Pl. 4, fig. 7). In *bella* however, the central tooth bears three cusps of the same size and the inner cusp of the marginals is larger than the outer (Powell 1951, p. 194, fig. 72). The shape of the teeth is also somewhat different in the two subspecies.

The shell of this subspecies is very similar to some species in the taenioglossate archibenthal and abyssal genus *Oocorys* (family Tonnidae, see Turner, 1948) and represents another case of parallel evolution among unrelated groups. Certain of the published records of *Oocorys* from southern high latitudes may well be based on species of *Tromina*.

*Records.* Known only from the type locality. See under 'Types'.

#### TROMINA TRAVERSEENSIS, new species

##### Plate 2, figure 8

Shell small (6.6 mm. long), buccinoid, weakly sculptured, and thin. Whorls  $3\frac{2}{3}$ , convex, shouldered, separated by a deep suture and forming a spire which subtends an angle of about  $80^\circ$ . Sculpture consisting of many narrow, low, rounded spiral ribs (about 43 on the body whorl of the holotype) which appear as whitish lines on a pale buff background, crossed by very fine, crowded lines of growth. Aperture large (about  $\frac{2}{3}$  the length of the shell), with numerous narrow, shallow grooves within, resulting from the external ribbing, and with a wide siphonal canal. Columella twisted. Parietal wall convex anteriorly and posteriorly and concave centrally and glazed with a thin callus which does not obscure the sculpturing beneath.

Outer lip thin, sharp, broadly convex and lightly crenulated by the spiral sculpture. Umbilicus small and nearly closed by the flexion of the parietal callus. Periostracum thin, yellowish brown, and occurring mainly between the spiral ribs. Nuclear whorls  $1\frac{1}{2}$ , nearly smooth, and forming a dome shaped protoconch. The holotype, containing the soft parts, has no operculum.

	height (mm.)	width (mm.)	whorls
holotype, station 49	6.6	4.5	$3\frac{2}{3}$
paratype, station 49	2.7	2.0	$2\frac{1}{4}$

*Types.* The holotype and paratype, respectively with and without the soft parts, were collected at R/V VEMA biology station 49 (1497 fathoms, south of Traverse Island, South Sandwich Islands). The holotype is in the Museum of Comparative Zoology, no. 224963. The paratype is in the National Museum of Canada, no. 4738.

*Remarks.* *T. traverseensis* is somewhat similar to *T. simplex* Powell 1951 in sculpturing, but *traverseensis* has strongly convex, shouldered whorls, an umbilicus, is very thin, and shows the external sculpturing within the aperture, while *simplex* has only lightly convex, unshouldered whorls, lacks an umbilicus, is substantially thicker, and does not exhibit the internal sculpturing within the aperture. Compared with *T. bella abyssicola* Clarke, *traverseensis* has much finer sculpturing and possesses an umbilicus while *abyssicola* does not.

*Records.* The only known specimens are the holotype and paratype. See under 'Types'.

Shells of what now appear to be three additional new species of *Tromina* (or possibly *Notoficula* Thiele 1917) are in the R/V VEMA material. Each is represented by a single specimen, of which two are somewhat broken empty shells and probably immature (from VEMA stations 47 and 53) and one is very young and contains the soft parts (station 47). So little is known of the degree of variation to be expected among these Antarctic whelks that it is quite uncertain whether these will prove to be outside the range of variation of known species or not. If they are similar to northern whelks in this regard (*Buccinum*, *Neptunea*, *Colus*, etc.), much variation may be expected. For this reason, I do not wish to describe them until more material is available and in further discussions will refer to them simply as *Tromina* a, b, and c, respectively.

Class PELECYPODA  
Order PROTOBRANCHIATA

Family NUCULIDAE

Genus NUCULA Lamarek 1799

Type species: *Arca nucleus* Linné, by monotypy.

NUCULA TURNERAE, new species

Plate 2, figures 2 and 3

Shell minute (1.8 mm. long), ovate, sub-inflated, nearly smooth, thin and with a broadly curved hinge plate bearing few teeth. Valves fragile and semi-transparent. Outline ovate except for the protruding umbones (which are placed about 36 per cent of the length from the posterior end), a slightly pointed anterior end (the longer end), and a somewhat flattened posterior end. Sculpture consisting of numerous fine lines of growth and microscopic radial lines. Larval valves very small, caplike and covering only the dorsal part of the umbones. Periostracum very thin and pale brown. Inner surface shiny, exhibiting well-marked muscle scars and a simple pallial line. Shell margin smooth and covered by periostracum. Hinge plate broadly curved, narrowed anterior to the chondrophore. Anterior row with three and posterior row with two, medium-sized, pyramidal, dorso-ventrally compressed taxodont teeth. Hinge plate expanded at the chondrophore which is small, triangular-ovate, and directed obliquely anteriorly. Umbones excavated.

	length (mm.)	height (mm.)	width (mm.)
holotype, station 12	1.8	1.5	1.0

*Types.* The holotype, an unique specimen, was collected alive at R/V VEMA biology station 12 (2805 fathoms, Argentine Basin, about 1000 miles east-southeast of Buenos Aires, Argentina). It is in the Museum of Comparative Zoology, no. 224959.

*Remarks.* The simple, plain and fragile shell of *turnerae* renders it distinct from all other abyssal nuculas from the South Atlantic Ocean. In general appearance it approaches *N. pernambucensis* Smith 1885 from off Recife, Brazil, in 675 fathoms (CHALLENGER, sta. 120), but that species is larger, much more quadrate and bears about eleven teeth in each valve while *turnerae* bears only five. It is possible that *turnerae* is immature, but the thin, fragile, nearly unsculptured shell is

typical of deep abyssal species and the tiny attached larval shell suggests that the holotype is probably adult or nearly so.

This species is named in honor of Dr. Ruth D. Turner who has generously aided the writer in numerous matters connected with this work.

*Records.* The holotype is the only known specimen. See under 'Types'.

### Genus PRONUCULA Hedley 1902

Type species: *Pronucula decorosa* Hedley 1912, original designation.

#### PRONUCULA BENGUELANA, new species

##### Plate 3, figures 9 and 11

Shell nuculiform, slightly inflated, small (about 3.5 mm. long), radially sculptured, thin and with a curved hinge plate. Valves semi-transparent and showing the teeth, intestine, etc. through the shell. Outline triangular-ovate, rounded and slightly pointed posteriorly, broadly curved ventrally, more abruptly curved anteriorly (sometimes slightly pointed) and with prominent, inflated umbones placed about 40 per cent of the length from the posterior end. Adult sculpture consists of numerous (about 65 to 75) narrow, rounded radial ribs over the whole central area crossed by crowded, microscopic lines of growth. Larval shells white, persistent, large (about 30 per cent of the height of the adult) and sculptured with fine concentric lines and microscopic radial lines. Periostracum thin, lustrous and light yellowish brown. Inner surface nacreous and exhibiting the external radial ribs. Muscle scars and simple pallial line well marked. Shell margin smooth, not crenulated. Hinge plate nearly straight posteriorly, rather sharply curved centrally and broadly curved anteriorly. Posterior row with six and anterior row with nine columnar, pointed, slightly curved teeth. Chondrophore small, triangular, approximately vertical and close to the innermost taxodont teeth. Umbones deeply excavated.

	length (mm.)	height (mm.)	width (mm.)
holotype, station 14	3.8	3.4	2.0
paratype, station 14	3.3	3.0	1.8
paratype, station 14	3.2	2.9	1.8
paratype, station 14	2.9	2.4	1.6



*Types.* The holotype and 26 paratypes, all living specimens, plus a single valve, were collected at R/V VEMA station 14 (1703 fathoms, Cape Basin, about 400 miles northwest of Cape-town, South Africa). The holotype is in the Museum of Comparative Zoology, no. 224964. Paratypes are in the Museum of Comparative Zoology and the National Museum of Canada.

*Remarks.* *Pronucula benguelana* is one of a widespread deep sea complex which includes *P. notobenthalis* (Thiele) 1912 from 1490 fathoms from the western end of the Eastern Indian Antarctic Basin and *P. profundorum* (Smith) 1885 from 2050 fathoms from the mid-North Pacific. It differs from *profundorum* in that *profundorum* is much more pointed posteriorly and the beaks are more centrally located. Conversely, from *notobenthalis* it differs in that the posterior extremity is much more rounded and the beaks are located more anteriorly in that species; also *notobenthalis* is much more oblique.

The name *benguelana* refers to the type locality, which is beneath the region traversed by the Benguela Current.

*Records.* In addition to the holotype and paratypes, there are thirteen specimens from station 47 (2054 fathoms, Scotia Sea, about 60 miles south of South Georgia) which are doubtfully referred to this species. They are very similar to the specimens from the type locality except that the larval shells are proportionately larger and the adult outline is more broadly curved posteriorly. Such differences may be expected between isolated populations of abyssal mollusks because of very restricted gene flow between them. In this case the differences are relatively minor and I prefer not to designate this population as a distinct subspecies.

### Family MALLETIIDAE

#### Genus MALLETIA Desmoulins 1832

Type species: *Malletia chilensis* Desmoulins, by monotypy.

#### MALLETIA PALLIDA Smith 1885

This species was taken at R/V VEMA biology station 47 and 52 (2054 fathoms, Scotia Sea, approximately 60 miles south of South Georgia; and 2711 fathoms, Agulhas Basin, approximately 800 miles southwest of Capetown, South Africa, respectively). A series of 15 specimens was collected at station 52, with individuals ranging from 3.0 to 19.5 mm. in length.



The larger specimens are identical to the figures in Smith (1885, pl. 20, figs. 8, 8a). The smaller specimens are very similar to the three small specimens from station 47, which otherwise would not have been recognized as belonging to *pallida*. The type locality is CHALLENGER station 137, 2550 fathoms, 35°59' S., 1°34' E., in the Cape Basin, not far from VEMA station 52.

MALLETIA JOHNSONI, new species

Plate 2, figure 6

Shell small (about 6 mm. long), rectangularly ovate, compressed, nearly smooth, very thin and fragile, and with a narrow, weak and almost straight hinge plate. Valves somewhat translucent, thin and brittle. Dorsal margin nearly straight; anterior margin rounded and curving smoothly to the ventral margin which is less sharply rounded; posterior broader than anterior and truncated. Umbones rather small, placed a little in front of center. Sculpture consisting only of fine lines of growth. Periostracum thin, shiny, and pale yellowish brown. Ligament extending from slightly in front of the beaks to near the posterior margin. Inner surface white, only slightly lustrous and with muscle scars and a relatively large pallial sinus located above the midline of the valves. Shell margin finely crenulated. Hinge plate narrow, nearly straight, a little bent down anteriorly, wider distally than centrally, and bearing about 7 anterior and 10 posterior small V-shaped taxodont teeth. Teeth larger distally and becoming obsolete and vanishing near the beaks. Umbones not excavated.

	length (mm.)	height (mm.)	width (mm.)
holotype, station 22	4.7	3.1	1.4
paratype, station 22	6.2	3.8	1.6
paratype, station 22	4.0	2.5	1.2

*Types.* The holotype and six paratypes were collected alive at R/V VEMA biology station 22 (1675 fathoms, Angola Basin, about 175 miles west of Banana, Belgian Congo). The holotype is in the Museum of Comparative Zoology, no. 224961. Paratypes are in the National Museum of Canada, no. 4737.

*Remarks.* *Malletia johnsoni* is characterized by its small size, its compressed, thin, and fragile valves, and its broad, truncate posterior end. It resembles the North Atlantic *M. obtusata* Sars in general, but that species is not broader posteriorly, the

beaks are farther forward and the valves are not convex. *M. dilatata* Philippi is much more heavily sculptured and the posterior end is more sharply truncated. *M. johnsoni* is not similar to any South Atlantic species.

This species is named in honor of Richard I. Johnson, who for many years has been a most enthusiastic and careful worker in malacology.

*Records.* In addition to the type lot, two specimens which probably belong to this species were collected at station 54 (993 fathoms, Cape Basin, about 65 miles northwest of Capetown, South Africa). They are very similar to the types except that the valves are a little larger (7.0 mm. long) and significantly more transparent. Seen through the shell, the number of teeth also appears to be a little greater, but this is no doubt because of the greater length.

#### MALLETIA CONCENTRICA Thiele 1912

Ten specimens of one species of *Malletia* ranging in length from 2.0 to 5.3 mm. were taken at R/V VEMA biology station 49 (1497 fathoms, Atlantic Indian Antarctic Basin, south of Traverse Island, South Sandwich Islands) and three other specimens ranging from 1.5 to 2.7 mm. in length were taken at station 16 (1660 fathoms, Cape Basin, approximately 175 miles west-northwest of Lüderitz, South-West Africa). The smaller specimens resemble Thiele's figures (1912: pl. 17, figs. 24, 24a) of *concentrica* very closely (the holotype is 2.75 mm. long) and probably belong to that species. The type locality of *concentrica* is 1872 fathoms northeast of Gauss Station in the western end of the Eastern Indian Antarctic Basin. Larger specimens of *concentrica* from station 49 are expanded post-basally and are quite unsymmetrical in shape. The species is markedly convex, the largest specimen measuring 5.3 mm. in length, 3.8 mm. in height and 2.8 mm. in width.

#### Genus TINDARIA Bellardi 1875

Type species: *Tindaria arata* Bellardi, by monotypy.

#### TINDARIA VIRENS Dall 1890

At R/V VEMA biology station 22 (1675 fathoms, Congo Canyon, Angola Basin, about 175 miles west of Banana, Belgian Congo) twelve living specimens were collected which agree closely with paratypes of *Tindaria virens* Dall. The only

observable difference is that the hinge teeth are a little heavier in the VEMA specimens than in *virrens*, but this difference is probably too slight to be given taxonomic significance. *T. virrens* was taken by Dall off southern Chile in 122 to 449 fathoms.

TINDARIA CHAMPIONI, new species

Plate 2, figures 1 and 4

Shell small (5.8 mm. long), veneriform, sub-inflated, moderately strong, rather weakly sculptured and with an angular hinge plate bearing taxodont hinge teeth. Outline oval except for the prominent beaks which are placed about 40 per cent of the way from the anterior end. Sculpture consisting of numerous narrow, very low, rounded concentric ribs, fine near the umbones and becoming coarser near the ventral margin, and crowded, exceedingly fine radial lines. Periostracum thin, light brown and beautifully iridescent. Ligament narrow, about 18 per cent the length of the shell, and extending posteriorly from under the umbones. Inner surface white, sub-naereous, with prominent muscle scars, pallial line and pallial sinus. Shell margin smooth. Hinge plate strong, bent and a little narrowed under the umbones and bearing seven anterior and nine posterior, erect, V-shaped, conical taxodont teeth. Teeth much higher in the center of each row, becoming obsolete near the umbones, and not meeting under the umbones. Umbones excavated.

	length (mm.)	height (mm.)	width (mm.)
holotype, station 12	5.8	4.8	2.8

*Types.* The holotype was taken alive at R/V VEMA biology station 12 (2805 fathoms, Argentine Basin, about 1000 miles east-southeast of Buenos Aires, Argentina). It is in the Museum of Comparative Zoology, no. 224957.

*Remarks.* *Tindaria championi* is another species of the veneriform, concentrically sculptured group in *Tindaria* which has a prominent pallial sinus (see *T. crebus* Clarke 1959b). *T. championi* may be distinguished from *T. crebus* by the much heavier sculpture, many more teeth, regularly curved central portion of the hinge plate, and larger size of *crebus*. It differs from *T. antarctica* Thiele and Jaekel in shape (subrectangular in *antarctica* and oval in *championi*), in the more anterior placement of the umbones in *antarctica*, and the number of posterior teeth which is much greater in *antarctica*. It is not closely similar to any other South Atlantic species.

This species is named for Merrill E. Champion who for many years has given much time and energy to the study of Recent mollusks at the Museum of Comparative Zoology.

*Records.* In addition to the holotype from station 12, seven additional specimens were collected at station 14 (1703 fathoms, Cape Basin, about 14 miles northwest of Capetown, South Africa). They differ from the holotype in their smaller size and less iridescent periostracum but are identical in all other respects.

#### TINDARIA ANTARCTICA Thiele and Jaeckel, 1931

One living specimen of this species was collected at R/V VEMA biology station 47 (2054 fathoms, western end of the Atlantic Indian Antarctic Basin, about 60 miles south of South Georgia) and another living specimen and two extra valves were collected at station 48 (1902 fathoms, about 100 miles southeast of South Georgia). They agree perfectly with the description and figure in Thiele and Jaeckel (1931, pl. 8, fig. 71) except for a slight difference in the number of teeth (8 anterior and 18 posterior instead of 6 and 20 as in *antarctica*) and their somewhat smaller size (8.5 mm. long instead of 11.5 mm.). The type locality of *antarctica* is VALDIVIA station 152 (2535 fathoms at 63°16.5' S., 57°51' E., eastern end of the Atlantic Indian Antarctic Basin).

#### CLENCHARIA, new subgenus

Type species: *Tindaria (Clencharia) diaphana* Clarke.

Shells small, ovate, thin, transparent and with numerous flattened taxodont teeth. Pallial sinus well developed. Taxodont teeth wedge shaped and flattened laterally. Sculpture concentric and microscopic.

*Clencharia* differs from *Tindaria* (*sensu stricto*) principally in the form of the teeth, the sculpturing and the thickness and transparency of the shell. The teeth in *Clencharia* are flattened and rectangular in cross-section while those of *Tindaria* are V-shaped in cross-section. The sculpturing in *Clencharia* is microscopic; in *Tindaria* it is not microscopic and is often prominent. The shell of *Clencharia* is very thin, diaphanous and transparent while that of *Tindaria* is relatively thick and not transparent.

This subgenus is named in honor of Dr. William J. Clench, a fine teacher and an outstanding authority on mollusks with whom the author has had the privilege of being associated.

## TINDARIA (CLENCHARIA) DIAPHANA, new species

## Plate 1, figure 2

Shell small (5.6 mm. long), sub-ovate, inflated, nearly smooth, very thin, transparent and with a weak hinge plate bearing about 15 flattened chisel-shaped teeth. Valves completely transparent and clearly exhibiting the entire animal within. Outline sub-ovate, broadly rounded postero-ventrally and ventrally, gradually rounded and straighter dorsally and more sharply curved anteriorly and postero-dorsally. Umbones rounded, inflated, and projecting above the hinge line at a point about 30 per cent of the distance from anterior to posterior. Sculpture consisting only of microscopic concentric lines and ridges of growth. Periostracum very thin, transparent and iridescent. Ligament very thin, extending posteriorly from under the umbones. Larval valves tiny and white. Interior smooth except for microscopic growth lines, glossy, and exhibiting well marked muscle scars, pallial line and pallial sinus. Shell margin smooth. Hinge plate compressed and narrow except a little wider anteriorly and somewhat thickened and sigmoid under the beaks, but otherwise following the dorsal margin of the valves. Hinge plate bearing six anterior and nine posterior dorso-ventrally compressed, chisel-shaped taxodont teeth. Teeth well developed but rather small (largest near the center of each row) and becoming obsolete and not meeting under the beaks. Umbones excavated.

	length (mm.)	height (mm.)	width (mm.)
holotype, station 52	5.6	4.1	2.8
paratype, station 52	5.7	4.2	2.9
paratype, station 52	4.4	3.2	1.9

*Types.* The holotype and two paratypes were taken at R/V VEMA biology station 52 (2711 fathoms, Agulhas Basin, about 800 miles southwest of Capetown, South Africa). The holotype (with a flake of orange paint from the dredge inside the shell) is in the Museum of Comparative Zoology, no. 224965. The paratypes are in the National Museum of Canada, no. 4741.

*Remarks.* *Tindaria (Clencharia) diaphana* is characterized by its frail, transparent, bulbous shell and by its peculiar chisel-shaped teeth. It can be differentiated from all other fragile taxodonts (e.g. *Glomus*, *Phaseolus*, *Sarepta*, etc.) by the general shape of the shell and the form of the teeth. For differences between this and *Tindaria (sensu stricto)*, see under *Clencharia*.

*Records.* Known only from station 52. See under 'Types'.

## Family NUCULANIDAE

## Genus NUCULANA Link 1807

Type species: *Arca rostrata* Chemnitz (= *Leda pernula* Müller), by monotypy.

## NUCULANA ULTIMA Smith 1885

*Nuculana ultima* Smith 1885, Challenger Report, Lamellibranchs, p. 324, text fig. (2740 fms., southwest of Canary Islands).

*Leda (Ledella) modesta* Thiele and Jaeckel 1931, Muscheln der deutschen Tiefsee-Expedition, p. 202, pl. 2, fig. 30 (1245 fms., Gulf of Guinea).

*Leda (Ledella) spreta* Thiele and Jaeckel 1931, loc. cit., p. 203, pl. 2, fig. 32 (69 fathoms, Agulhas Bank).

Living specimens of *Nuculana ultima* were taken by the VEMA at stations 12, 23, 47, 51, and 52 (2504 to 2805 fathoms; Argentine, Angola and Agulhas basins and Scotia Sea). Several specimens were collected at each locality and large series were obtained at stations 12 and 52. The species is quite variable as to the presence or absence of a short rostrum, in the strength of the hinge plate, and especially in the thickness and inflation of the shell. Apparently when the species reaches adult length and height further growth takes place at the inner edge of the shell and it becomes progressively more obese. At the same time the whole shell thickens. In one lot (station 52) this has resulted in sufficient variation so that width/height ratios vary from .65 to .95 among adult specimens. *Nuculana ultima* Smith was described from a single specimen, and *modesta* and *spreta* Thiele and Jaeckel were also represented by only a few shells. These authors apparently obtained isolated examples of an unusually variable species and under such conditions they appeared distinct.

## Subgenus THESTYLEDA Iredale 1929

Type species: *Leda ramsayi* Smith, original designation.

## NUCULANA (THESTYLEDA) LOUISEAE, new species

## Plate 1, figure 7

Shell medium sized (19 mm.), rather thin, narrow, rostrate, compressed, strongly sculptured and with numerous oblique, lamellar, taxodont teeth. Valves ovate anteriorly, with a long, arcuate, posterior rostrum and with small umbones placed close together and about 30 per cent of the length from the anterior



end. Rostrum narrow, truncate and bilobed distally, concave dorsally and ventrally and surmounted with two prominent, curved carinae on each valve running from the umbones to the distal end. The lower carina is larger and becomes double as it proceeds posteriorly. Carinae crossed by crisp, narrow, wave-like ridges, which on the upper carina are convex and on the lower carina are concave dorsally and sharply convex ventrally. Ridges continuing on the disc as narrow, rounded, closely spaced ribs following lines of growth. Between the long, thin, external ligament and the rostral carinae is a smooth, almost unsculptured area, extending from the umbo and becoming narrow and obsolete near the posterior end. Periostracum thin, light grayish yellow. Inner surface of valves mostly white, nacreous, showing the external sculpturing and numerous, weak radial lines. Anterior muscle scar circular and faint, posterior scar irregularly ovate, and pallial line indistinct. Hinge teeth compressed, v-shaped, lamellar, very oblique, rather high and firmly interlocking, about 12 anteriorly and 20 posteriorly. Internal resilium in two separate but adjacent parts, the anterior part small and round, the posterior part large and saddle shaped. Umbones not excavated.

	length (mm.)	height (mm.)	width (mm.)
holotype, station 12	19.0	7.0	3.5

*Types.* The holotype, an unique specimen, was collected at R/V VEMA biology station 12 (2805 fathoms, Argentine Basin, about 1000 miles east-southeast of Buenos Aires, Argentina). It is in the Museum of Comparative Zoology, no. 224958.

*Remarks.* *Nuculana louseae* is characterized by its very long and narrow rostrum and its peculiar sculpture. Apparently it is not closely related to any other living species. It is somewhat similar to *Leda longicaudata* Thiele 1912 from the western end of the Eastern Indian Antarctic Basin, but in that species the rostrum is less extended, differently sculptured, and convex ventrally, while in *louseae* it is concave. Compared with *Nuculana scalata* Prashad, from 500 fathoms near the Lesser Sunda Islands, northeast Indian Ocean, *louseae* is higher and much more expanded anteriorly and with the umbones placed more posteriorly.

This species is named in honor of my wife, Louise R. Clarke, who has been a constant source of help in my work on the Mollusca.

*Records.* Known only from the type locality. See under 'Types'.



## Genus SPINULA Dall 1908

Type species: *Leda (Spinula) calcar* Dall, original designation.

## SPINULA SUBEXCISA (Dautzenberg and Fischer) 1897

Specimens which are here referred to *Spinula subexcisa* were collected at R/V VEMA biology stations 12, 14, 18, 19, 51 and 52 (1510-2805 fathoms, Argentine, Agulhas and Cape basins and Walvis Ridge).

Jeffreys (1876, 1879) recorded *Malletia excisa* (Philippi) in his reports on the VALOROUS and the LIGHTNING and PORCUPINE expeditions from 1125 to 1785 fathoms in the West Europe and Canaries basins. Comparisons with the Jeffreys Collection now in the United States National Museum show that the VEMA specimens cited here are identical to *M. excisa*, as Jeffreys understood it. Philippi's figure (1844, pl. 15, fig. 4) is of a different species however; it is a Tertiary fossil which is much more deeply excavated below the rostrum than is the VEMA species. This lack of agreement between the fossil and the recent abyssal species was recognized by Dautzenberg and Fischer (1897: 203) who proposed "var. *subexcisa*" for the modern species previously recorded by Jeffreys and others as *excisa*.

I consider that the present species is so different from the fossil *excisa* that it certainly deserves specific rank.

## SPINULA MESSANENSIS ("Seguenza" Jeffreys) 1879

A single specimen was collected alive at R/V VEMA biology station 20 (2707 fathoms, Angola Basin, about 675 miles west of Walvis Bay, South-West Africa). It is very close to *messanensis* which has been recorded from the West Europe and Canaries Basin in 276 to 1731 fathoms (Locard 1897) and although it may later prove to be significantly (and subspecifically) different when more material is obtained this question cannot be decided now.

## Order ANISOMYARIA

## Family MYTILIDAE

## Genus DACRYDIUM Torell 1859

Type species: *Modiola vitrea* Möller, by monotypy.

## DACRYDIUM ALBIDUM Pelseneer 1903

Living specimens of what appear to be this species were collected at R/V VEMA stations 16, 18 and 25 (Cape, Angola and Guinea basins, 1660 to 2315 fathoms). They are almost completely transparent and reveal the entire animal within. In this they differ from *albidum*, and in a group so lacking in taxonomic characters this may be significant, but for the present they are considered as abyssal and depauperate representatives of that species.

## Family PECTINIDAE

## Genus PSEUDAMUSIUM Mörch 1853

Type species: *Ostrea hybrida* Gmelin, subsequent designation, Dall 1898.

## PSEUDAMUSIUM PTERIOLA (Melville and Standen) 1907

A single valve of this species was collected at R/V VEMA biology station 46 (2030 fathoms, Scotia Sea, about 60 miles south of South Georgia). The type locality of *pteriola* is: Scotia Bay, South Orkney Islands, 9 to 10½ fathoms. Apparently this valve is adventitious.

## Genus PROPEAMUSSIUM de Gregorio 1883

Type species: *Pecten (Propeamussium) ceciliae* de Gregorio, by monotypy.

## PROPEAMUSSIUM (PARVAMUSSIUM) OCTODECIMLIRATUM

## (Melville and Standen) 1907

One living specimen plus a fragment of what appears to be this species were taken at R/V VEMA biology station 51 (2507 fathoms, Agulhas Basin, about 1000 miles southwest of Cape-town, South Africa). It differs from *octodecimliratum* in the possession of 13 instead of 18 internal ribs, but since it is only 4.3 mm. high (the holotype of *octodecimliratum* is 9.0 mm. high) this difference is probably attributable to age. Occasional specimens of *Propeamussium* (e.g. *P. dalli* Smith) interpolate additional ribs with growth, and this may occur in the present species. The type locality of *P. octodecimliratum* is: 2500 fathoms, 67°33' S., 36°35'W., western end of Atlantic Indian Antarctic Basin.

## Family LIMIDAE

Genus LIMATULA S. Wood 1839

Type species: *Pecten subauriculata* Montagu, subsequent designation, Gray 1847.

LIMATULA SIMILLIMA (Thiele) 1912

One valve of this species occurred at R/V VEMA biology station 14 (1703 fathoms, Cape Basin, about 400 miles northwest of Capetown, South Africa). It was perforated with a neat, round hole, apparently caused by a gastropod. Such perforations are rare among abyssal mollusks and this specimen is probably adventitious in the deep sea. The type locality is Gauss Station in the southwestern part of the Eastern Indian Antarctic Basin.

## Order EULAMELLIBRANCHIA

## Family THYASIRIDAE

Genus THYASIRA "Leach" Lamarck 1818

Type species: *Tellina flexuosa* Montagu, by monotypy.

THYASIRA FERRUGINOSA (Forbes) 1844

Living specimens were collected at VEMA stations 16, 22 and 47 (1660, 1675 and 2056 fathoms in the Cape and Angola basins and the Scotia Sea). They were particularly common at station 16. They closely resemble specimens of the wide-ranging North Atlantic archibenthal and abyssal species *T. ferruginosa*, and are tentatively referred to that species.

## Order SEPTIBRANCHIATA

## Family POROMYACIDAE

Genus POROMYA Forbes 1844

Type species: *P. anantinoidea* Forbes (= *P. granulata* Nyst), by monotypy.

POROMYA SUBLEVIS Verrill 1884

A single living specimen of *Poromya* which is apparently identical with Dall's holotype of *P. microdonta* (= *P. sublevis* Verrill) was collected at R/V VEMA biology station 25 (2315 fathoms, Guinea Basin, approximately 675 miles south of

Accra, Gold Coast). The type locality is in the North American Basin, 125 miles off Chesapeake Bay, Virginia, in 1685 fathoms. Dall (1889b) has extended the range of this species to "Pata-gonia" and "West America" but without station data or other explanation. These records need confirmation.

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